

# GETTING STARTED

# NI ISM-7400/7401/7402

# Integrated Steppers and NI 9512 C Series Modules



**Note** If you are a new user of LabVIEW or are unfamiliar with LabVIEW, refer to the *Getting Started with LabVIEW* manual for information about LabVIEW and LabVIEW terminology.

This document explains how to install and configure the NI ISM-7400/7401/7402 integrated steppers for use with the NI 9512 C Series drive interface module.

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# What You Need to Get Started

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You need the following items to get started.

## Hardware

- ☐ NI 9512 C Series stepper drive interface module
- ☐ NI real-time controller
  - CompactRIO controller and chassis that support the RIO Scan Interface



**Tip** To determine if your controller and chassis support the RIO Scan Interface go to [ni.com/info](http://ni.com/info) and enter the Info Code `rdsoftwareversion`.

or

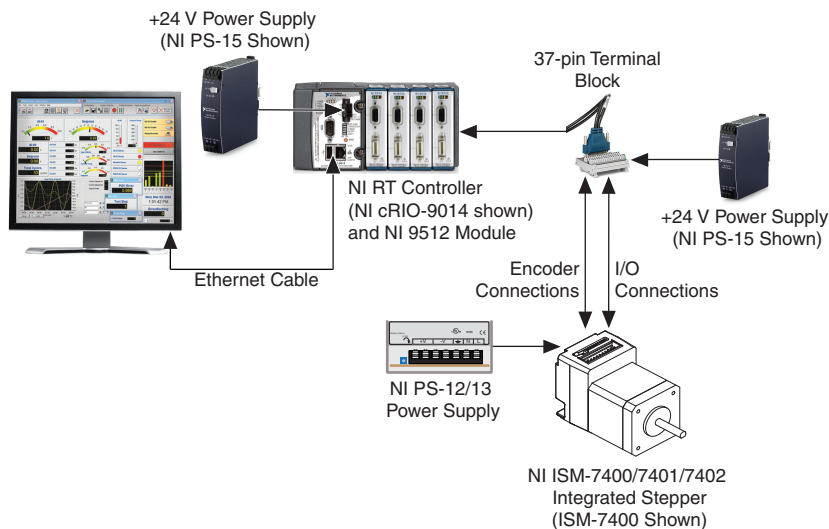
- NI 9144 distributed chassis and compatible RT controller
- ☐ +24 V power supply (such as the NI PS-15) for the CompactRIO controller (NI part number 781093-01)
- ☐ Separate +24 V power supply for the NI 9512 (such as the NI PS-15)
- ☐ NI PS-12 or NI PS-13 power supply for the NI integrated stepper
- ☐ Ethernet connection and cable for the CompactRIO controller
- ☐ NI 951x Cable and Terminal Block bundle (NI part number 780553-01)
- ☐ NI ISM-7400/7401/7402 integrated stepper

## Software

- ☐ LabVIEW 2010 or later
- ☐ LabVIEW 2010 Real-Time Module or later
- ☐ LabVIEW 2010 NI SoftMotion Module or later
- ☐ NI-RIO 3.5.0 or later

Figure 1 shows the required hardware and software.

**Figure 1. NI 9512 to NI ISM Connections**



## Related Documentation

The following documents contain additional information that you may find helpful. All referenced documents ship with the product and are available at [ni.com/manuals](http://ni.com/manuals).

- Operating instructions for the controller and C Series module.
- *NI ISM-7400 User Manual* or *NI ISM-7401/7402 User Manual*
- *LabVIEW NI SoftMotion Module Help*—Use this help file to learn about using the NI SoftMotion Module in LabVIEW including information about function blocks and using the NI SoftMotion Module with the LabVIEW Project. To access this help file from LabVIEW, select **Help»LabVIEW Help**, then expand the *LabVIEW NI SoftMotion Module* book on the **Contents** tab.
- *LabVIEW Help*—Use the *LabVIEW Help* to access information about LabVIEW programming concepts, step-by-step instructions for using LabVIEW, and reference information about LabVIEW VIs, functions, palettes, menus, tools, properties, methods, events, dialog boxes, and so on. The *LabVIEW Help* also lists the LabVIEW documentation resources available from National Instruments. Access the *LabVIEW Help* by selecting **Help»LabVIEW Help**.
- *Getting Started with LabVIEW*—Use this document as a tutorial to familiarize yourself with the LabVIEW graphical programming environment and the basic LabVIEW features you use to build data acquisition and instrument control applications. Access the *Getting Started with LabVIEW* PDF by selecting **Start»All Programs»National Instruments»LabVIEW»LabVIEW Manuals»LV\_Getting\_Started.pdf**.

# Hardware Installation and Configuration

This section covers the hardware setup for the CompactRIO system, NI 9512 C Series module, and NI ISM-7400/7401/7402 integrated stepper.

## Step 1: Set Up the CompactRIO System

Complete the following steps to set up the CompactRIO hardware.

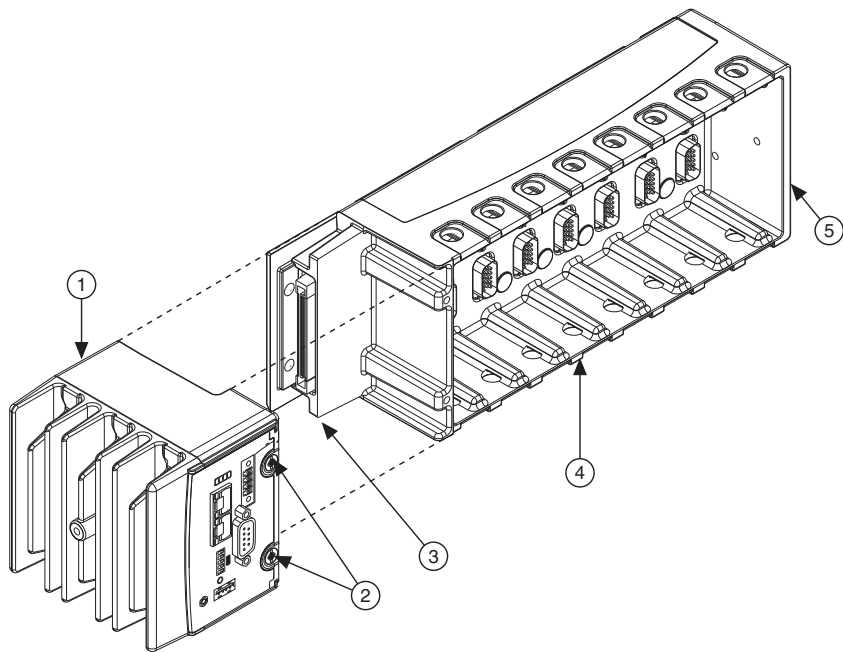
1. Install the real-time CompactRIO controller on the chassis if you are not using an integrated controller and chassis.



**Note** Write down the controller serial number before installing the controller onto the chassis. You will be unable to read the serial number after you install the controller.

- a. Make sure that no power is connected to the controller or the chassis.
- b. Align the controller with the chassis as shown in Figure 2.

**Figure 2.** Installing the Controller on the Chassis (Eight-Slot Chassis Shown)



|   |                 |   |                                 |
|---|-----------------|---|---------------------------------|
| 1 | Controller      | 4 | Reconfigurable Embedded Chassis |
| 2 | Captive Screws  | 5 | Grounding Screw                 |
| 3 | Controller Slot |   |                                 |

- c. Slide the controller onto the controller slot on the chassis. Press firmly to ensure the chassis connector and the controller connector are mated.
  - d. Using a number 2 Phillips screwdriver, tighten the two captive screws on the front of the controller.
- Connect the controller to a power supply and an Ethernet network on the same subnet as the development computer. Refer to the controller operating instructions for information about wiring the controller to the power supply and Ethernet network.



**Note** Do not plug in or turn on any power to the system until after you complete *Step 11: Power on the Drive and Verify Connections*.

- Install the NI 9512 module in slot 1, 2, 3, or 4 of the chassis.

## Step 2: Connect the NI 9512 to the 37-Pin Terminal Block

- Connect the MDR and DSUB connectors on the NI 951x Y-cable to the MDR and DSUB connectors on the NI 9512 module.
- Connect the 37-pin DSUB to the DSUB connector on the NI 951x terminal block.

Figure 3 shows the 37-pin terminal block pin assignments.

**Figure 3. NI 9512 37-Pin Terminal Block Pin Assignments**

|                               |  |  |                               |
|-------------------------------|--|--|-------------------------------|
| Forward Limit                 |  |  | Digital Output 1 <sup>†</sup> |
| Home                          |  |  | Reverse Limit                 |
| COM                           |  |  | Reserved                      |
| Digital Input 0               |  |  | V <sub>sup</sub>              |
| COM                           |  |  | Reserved                      |
| Encoder 0 Index+              |  |  | COM                           |
| Encoder 0 Index–              |  |  | Encoder 0 Phase A+            |
| COM                           |  |  | Encoder 0 Phase A–            |
| +5V OUT                       |  |  | Encoder 0 Phase B+            |
| Position Compare              |  |  | Position Capture              |
| Reserved                      |  |  | Encoder 0 Phase B–            |
| Reserved                      |  |  | Reserved                      |
| Digital Output 0 <sup>†</sup> |  |  | Reserved                      |
| V <sub>sup</sub> <sup>†</sup> |  |  | COM <sup>†</sup>              |
| Digital Input 1 <sup>†</sup>  |  |  | Drive Enable <sup>†</sup>     |
| Direction (CCW)+ <sup>†</sup> |  |  | Digital Input 3 <sup>†</sup>  |
| COM <sup>†</sup>              |  |  | Direction (CCW)– <sup>†</sup> |
| Step (CW)+ <sup>†</sup>       |  |  | Digital Input 2 <sup>†</sup>  |
| Shield                        |  |  | Step (CW)– <sup>†</sup>       |

<sup>†</sup> Indicates DSUB connector signals.

## Step 3: Connect the 37-Pin Terminal Block to the +24 V Power Supply

1. Connect the V+ terminal from the 24 V power supply to one of the two  $V_{sup}$  inputs on the 37-pin terminal block. The 37-pin terminal block provides a  $V_{sup}$  input for the NI 9512 on pin 14 and pin 22.
2. Connect the V- terminal from the 24 V power supply to one of the COM terminals on the 37-pin terminal block. The 37-pin terminal block provides COM on pins 3, 5, 8, 17, 24, and 32.

## Step 4: Connect the Drive Command Signals

The NI ISM-7400/7401/7402 integrated steppers support both single-ended and differential stepper commands. This document provides instruction for single-ended connection only.

1. Connect the integrated stepper Step- wire (brown) to the 37-pin terminal block Step (CW)+ terminal (pin 18).
2. Connect the integrated stepper Dir- wire (green) to the 37-pin terminal block Direction (CCW)+ terminal (pin 16).
3. Connect the integrated stepper Step+ wire (orange) and Dir+ wire (yellow) to the 37-pin terminal block +5V OUT terminal (pin 9).

## Step 5: Connect the Drive Enable Signal

Complete the following steps to connect the Drive Enable signal, which controls the enable function of the drive:

1. Connect the En- wire (purple) to the 37-pin terminal block COM terminal (pin 5).
2. Connect the En+ wire (blue) to the 37-pin terminal block Drive Enable terminal (pin 33).

## Step 6: (Optional) Connect the Drive Fault Signal

Complete the following steps to map an NI 9512 digital input to the Out signal to monitor the NI integrated stepper for faults:

1. Connect the Out+ wire (grey) to the 37-pin terminal block  $V_{sup}$  terminal (pin 22).
2. Connect the Out- wire (white) to the 37-pin terminal block DI 0 terminal (pin 4).



**Note** If you do not connect the Out+ and Out- signals to the 37-pin terminal block, insulate the wires.


# Step 7: Connect the Encoder Signals

If your NI ISM includes an encoder, connect the encoder cable to the integrated stepper using the included connector, and connect the encoder wires to the 37-pin terminal block as indicated in Table 1.

**Table 1.** NI ISM to 37-Pin Terminal Block Connections

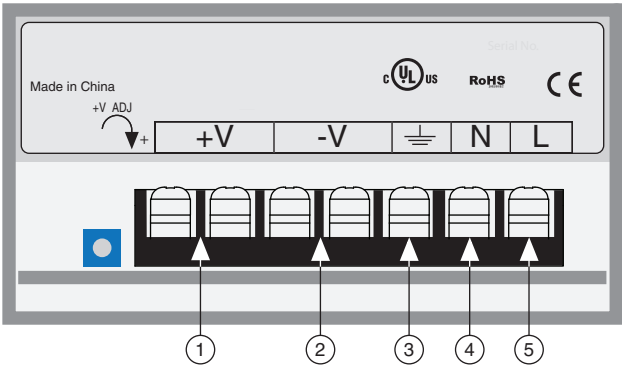
| NI ISM<br>Signal Name | Wire Color   | 37-Pin<br>Terminal Block<br>Pin Number | 37-Pin<br>Terminal Block<br>Signal Name |
|-----------------------|--------------|--|---|
| A                     | blue         | 25                                     | Encoder 0 Phase A+                      |
| $\overline{A}$        | blue/white   | 26                                     | Encoder 0 Phase A-                      |
| B                     | brown        | 27                                     | Encoder 0 Phase B+                      |
| $\overline{B}$        | brown/white  | 29                                     | Encoder 0 Phase B-                      |
| I                     | orange       | 6                                      | Encoder 0 Index+                        |
| $\overline{I}$        | orange/white | 7                                      | Encoder 0 Index-                        |
| GND                   | green/white  | 8                                      | COM                                     |
| +5V                   | green        | 9                                      | +5V OUT                                 |

# Step 8: Connect the NI PS-12/13 Power Supply

 **Note** Do not plug in or turn on the power supply until after you complete *Step 11: Power on the Drive and Verify Connections*.

Complete the following steps to connect the power supply to AC input power and to the NI integrated stepper. Figure 4 shows the power supply terminals.


**Figure 4.** NI PS-12/13 Power Supply Terminals



- |   |                    |
|---|--------------------|
| 1 +24 V (NI PS-12) or +48 V (NI PS-13) Output | 4 AC Input Neutral |
| 2 +24 V (NI PS-12) or +48 V (NI PS-13) Ground | 5 AC Input Line    |
| 3 AC Input Ground (Protective Earth)          |                    |
1. Connect an AC input cable to the line, neutral, and ground (protective earth) connectors.
  2. Connect the integrated stepper V+ (red) wire to the power supply +V connector.
  3. Connect the integrated stepper V- (black) wire to the power supply -V connector.
  4. Connect the NI 9512 COM to the NI PS-12/13 -V terminal to ensure a common reference.

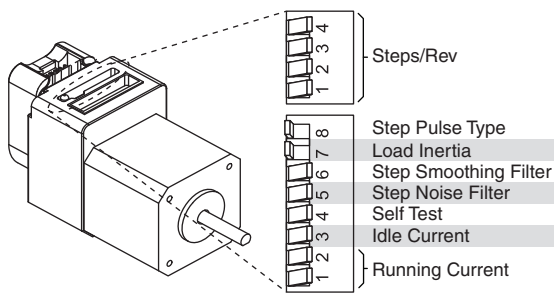
# Step 9: Configure the NI ISM-7400/7401/7402 DIP Switches

The NI ISM-7400/7401/7402 integrated steppers provide drive configuration DIP switches. Refer to the *NI ISM-7400/7401/7402 User Manual* for more information about the DIP switch options. The following figure shows the DIP switch location and functions.

 **Note** If you change the DIP switch settings you must power cycle the NI ISM for the new settings to take effect.

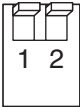






**Figure 5.** NI ISM-7400/7401/7402 DIP Switches



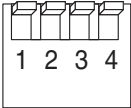


Refer to Table 2 for the DIP switch settings that this document uses.

**Table 2.** DIP Switch Settings

| Setting Name          | Switch Position   | Corresponding Value |
|-----------------------|---|---------------------|
| Running Current       |    | 100%                |
| Idle Current          |    | 50%                 |
| Self Test             |   | Off                 |
| Step Noise Filter     |  | 2 MHz               |
| Step Smoothing Filter |  | Off                 |

**Table 2. DIP Switch Settings (Continued)**

| Setting Name    | Switch Position   | Corresponding Value |
|-----------------|---|---------------------|
| Load Inertia    |  | 0 - 4X              |
| Step Pulse Type |  | Step/Dir            |
| Step Size       |  | 25000               |

## Step 10: Cut Off and Insulate the NC Wire

The NC wire on the NI ISM-7400/7401/7402 is unused. NI recommends removing and insulating this wire for optimal operation.

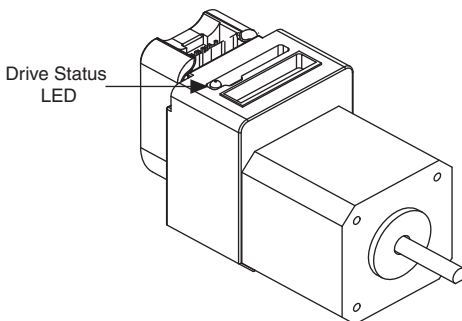
1. Cut off the NC wire.
2. Insulate the end of the wire if there is any exposed metal remaining.

## Step 11: Power on the Drive and Verify Connections

After all hardware connections have been made complete the following steps to confirm the hardware setup.

1. Turn on all power supplies.
2. Verify that the Drive Status LED on the NI ISM flashes or is solid green. Figure 6 shows the location of the Drive Status LED.

**Figure 6.** Drive Status LED Location



If the Drive Status LED does not flash or turn solid green, turn off all power, verify the connections, and try again.

## Software Installation and Configuration

This section covers installing and configuring software for the NI 9512 C Series module.



**Note** These instructions assume you have installed all required software from the [What You Need to Get Started](#) section on your development machine.


### Step 1: Install Software on and Configure the NI RT Controller

Complete the following steps to configure the controller and install software on it.



**Note** The Measurement & Automation Explorer (MAX) user interface may not match these steps exactly depending on which version of MAX you are using.

## Verify the NI RT Controller

1. Launch Measurement & Automation Explorer (MAX) on the development computer by clicking the MAX icon on the desktop () or by selecting **Start»All Programs»National Instruments»Measurement & Automation**.
2. Expand the **Remote Systems** tree.
3. Highlight the system.



**Note** If you do not see the controller, you may need to disable the firewall on the development computer. Go to [ni.com/info](http://ni.com/info) and enter RIOMAXTroubleshoot for more information.

4. Verify that the **Serial Number** in the **General Settings** section matches the serial number on the device.

If you do not want to format the disk on the controller, eliminating all installed software and files, skip to *Install Software on the NI RT Controller*.

## Reformat the NI RT Controller (Optional)

1. Set the **Safe Mode** switch on the controller to the **On** position.
2. Power on the controller. If it is already powered on, press the **Reset** button on the controller to reboot it.
3. Right-click the controller under **Remote Systems** in the **Configuration** pane in MAX and select **Format Disk**.
4. (Optional) Enable the **Keep Network Settings** checkbox if you want to retain the same target name and IP address.
5. Click **Format** to start formatting the disk.
6. When MAX finishes formatting the disk, set the **Safe Mode** switch to the **Off** position and click **OK**.
7. Select the **System Settings** tab on the bottom and type a descriptive name for the system in the **Hostname** field.
8. (Optional) Complete this step only if the target has an empty IP address (0.0.0.0). Select the **Network Settings** tab and select **DHCP or Link Local** from the **Configure IPv4 Address** list to assign an IP address or select the **Static** to specify a static IP address in the **IPv4 Address** section.
9. Click **Save** on the toolbar and let MAX reboot the system. You may not need to complete this step if you did not change the IP address or name.

## Install Software on the NI RT Controller

1. When the new system name appears under **Remote Systems**, expand the controller item in the tree, right-click **Software**, and select **Add/Remove Software**.
2. Select a recommended software set that includes NI-RIO 3.5.0 or later.
3. Click **Next**.

4. Select **LabVIEW NI SoftMotion Module** from the add-ons list.



**Note** If you are using the NI SoftMotion Module 2010 SP1 or earlier, also select **LabVIEW NI SoftMotion Module Scan Engine Support** from the list.

5. Click **Next** to install the selected software on the controller. Click **Help** if you need information about installing recommended software sets.
6. When the software installation completes, click **Finish** to reboot the controller.
7. Close MAX.

## Step 2: Create a Project in Scan Interface Mode

Scan Interface mode enables you to use C Series modules directly from LabVIEW Real-Time. Modules that you use in Scan Interface mode appear directly under the chassis item in the **Project Explorer** window. Unlike most C Series modules, NI 951x modules are not directly configurable from the **Project Explorer** window and no I/O variables are directly available under the module.



**Tip** Refer to the *Select Programming Mode Dialog Box* topic of the *CompactRIO Reference and Procedures (Scan Interface)* help file for more information about Scan Interface mode.

Use a LabVIEW project to manage VIs, targets, and I/O modules on the development computer. Complete the following steps to create a LabVIEW project.

1. Launch LabVIEW.
2. Select **File»Create Project** or **Project»Create Project** to display the **Create Project** dialog box. You can also click the **Create Project** button on the Getting Started window. The **Create Project** dialog box includes a list of templates and sample projects you can use to ensure that the project you create uses reliable designs and programming practices.
3. Select **Blank Project** from the list of templates.
4. Click **Finish**.
5. Select **Help** and make sure that **Show Context Help** is checked. You can refer to the context help throughout the tutorial for information about items on the block diagram.

## Step 3: Add Resources to the Project

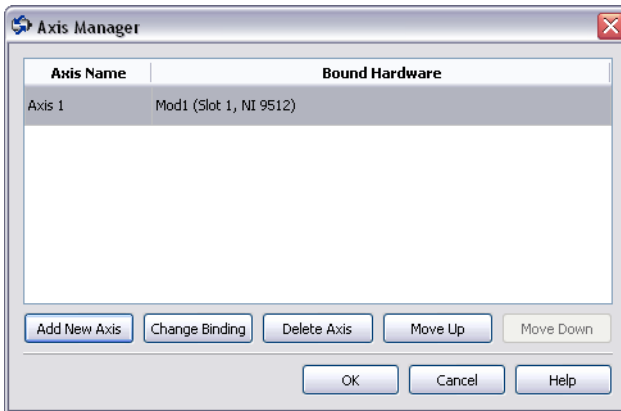
1. Right-click the top-level project item in the **Project Explorer** window and select **New»Targets and Devices** from the shortcut menu to display the **Add Targets and Devices** dialog box.
2. Make sure that the **Existing target or device** radio button is selected.
3. Expand **Real-Time CompactRIO**.
4. Select the CompactRIO controller to add to the project and click **OK**.
5. If you have LabVIEW FPGA installed, the **Select Programming Mode** dialog box appears. Select **Scan Interface** to put the system into Scan Interface mode.



**Tip** Use the **CompactRIO Chassis Properties** dialog box to change the programming mode in an existing project. Right-click the CompactRIO chassis in the **Project Explorer** window and select **Properties** from the shortcut menu to display this dialog box.

6. Click **Discover** in the **Discover C Series Modules?** dialog box if it appears.
7. Click **Continue**.
8. Right-click the controller item in the **Project Explorer** window and select **Properties** from the shortcut menu to display the **RT Target Properties** dialog box. Select **Scan Engine** from the **Category** list to display the Scan Engine page.
9. Set the **Scan Period** to 5 ms, then click **OK** to close the **RT Target Properties** dialog box.
10. Right-click the controller item in the **Project Explorer** window and select **New» NI SoftMotion Axis** from the shortcut menu to open the **Axis Manager** dialog box, shown in Figure 7.
11. Click **Add New Axis** to create an NI SoftMotion axis associated with the NI 9512 module. Axes are automatically bound to an available module. You can double-click the axis name to rename the axis and give it a descriptive name.

**Figure 7.** Axis Manager Dialog Box



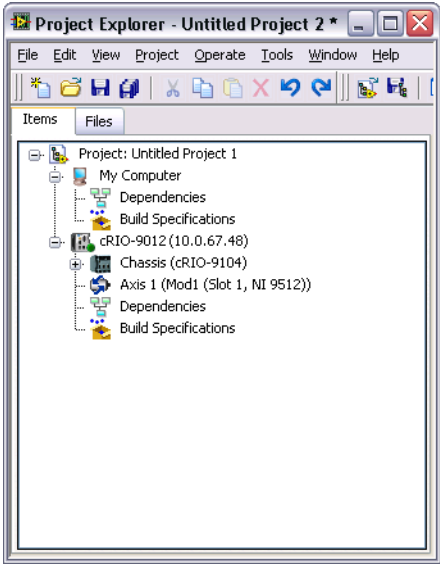
12. Click **OK** to close the **Axis Manager** dialog box. The new axis is added to the **Project Explorer** window.



**Note** You cannot associate more than one axis with the same C Series module.

When you have finished these steps your LabVIEW project should look similar to the image in Figure 8.

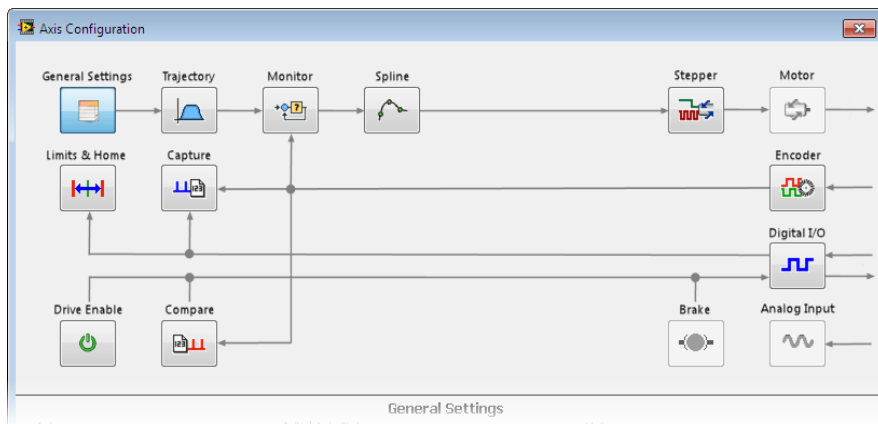
**Figure 8.** Project Explorer Window with Modules in Scan Interface Mode



## Step 4: Configure the NI 9512 Axis


The **Axis Configuration** dialog box includes configuration options for stepper drive command signals, feedback devices, motion and digital I/O, trajectory, and axis setup. Figure 9 shows the parts of the **Axis Configuration** dialog box for NI 9512 C Series module. Refer to the *NI SoftMotion Module* book of the *LabVIEW Help* for detailed information about each configuration option.

**Figure 9.** Axis Configuration Dialog Box



**Note** The **Axis Configuration** dialog box user interface may not match this image exactly depending on which version of the LabVIEW NI SoftMotion Module you are using.


Complete the following steps to configure the axis I/O settings for use with the NI ISM integrated stepper.

1. Right-click the axis in the **Project Explorer** window and select **Properties** from the shortcut menu to open the **Axis Configuration** dialog box.
2. Configure the following settings on the **General Settings** page (  ).
  - a. Confirm that **Loop Mode** is set to **Open-Loop**. Axes configured in open-loop mode produce step outputs but do not require feedback from the motor to verify position.
  - b. Set **Feedback Source** to **Encoder 0**, if you have connected an encoder, or **None** if you do not have an encoder connected.
  - c. Confirm that the **Axis Enabled** and **Enable Drive on Transition to Active Mode** checkboxes contain checkmarks. These selections configure the axes to automatically activate when the NI Scan Engine switches to Active mode.



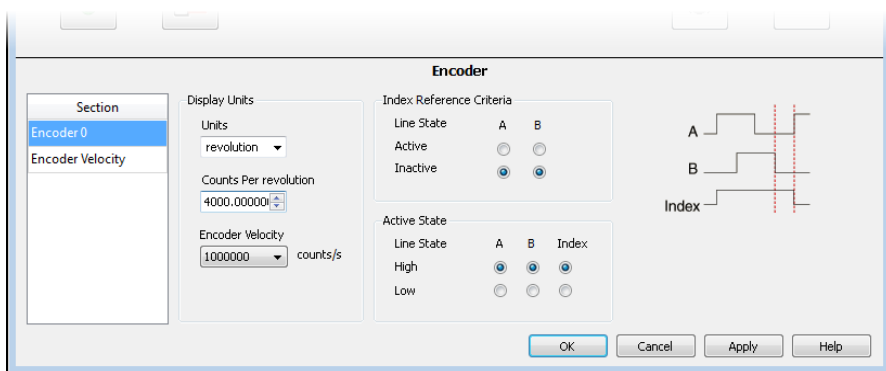
**Note** Disable these options to prevent axes from automatically activating when the NI Scan Engine switches to Active mode.




3. If you have connected an encoder, click the Encoder button (  ) and configure the Units and Counts Per Unit.
  - a. In the **Active State** section set the **Line State** for **A**, **B**, and **Index** to **High**.
  - b. In the **Index Reference Criteria** section set the **Line State** for **A** and **B** to **Inactive**.
  - c. Select **rev** from the **Units** text box, or type **revolutions** if you prefer.
  - d. Set the **Counts per rev** to 4,000. This setting is the encoder resolution in quadrature counts per revolution and corresponds to the encoder lines per revolution multiplied by four.

When you are finished the Encoder Settings page will look similar to Figure 10.


**Figure 10.** Axis Configuration Encoder Page



4. Click the **Stepper** button (  ) to open the **Stepper** page.
  - a. Ensure that the Stepper Output settings match the following:
    - **Output Mode**—Step and Direction
    - **Output Type**—Single-Ended
    - **Active State**— Low
  - b. Configure the Units and Steps Per Unit.
    - Select **rev** from the **Units** text box, or type **revolutions** if you prefer.
    - Set **Steps Per revolution** to 25,000.






**Note** The **Steps Per revolution** setting *must* match the Steps/Rev DIP switch setting. If you change the Steps/Rev setting using the DIP switches, update this setting to match.

- c. (Optional) Click the **Monitor** button (  ) and make the following changes to enable NI SoftMotion to disable the drive and turn off the Drive Enable signal when the specified position error limit is exceeded.



**Note** The **Monitor** button is greyed out if **Feedback Source** on the **Axis Settings** page is set to **None**.

- Enable the **Enforce Position Error Limit** checkbox.
  - Set **Position Error Limit** to a reasonable tolerance for your system, such as 1
5. Click the **Drive Enable** button (  ) and ensure that the Drive Enable settings match the following:
    - **Output Type**—Sourcing
    - **Active State**—Off
    - **Safe State**—On
  6. If you connected the Out+/Out- signal, click the Digital I/O button (  ) and complete the following steps to configure the DI 0 signal:
    - a. Double-click the text in the **Mapping** column and select **Drive Fault/Alarm** from the dropdown list.
    - b. Ensure that the DI 0 settings match the following:
      - **Input Type**—Sinking
      - **Active State**—On
      - **Digital Filter**—50  $\mu$ s
  7. Complete the following additional steps if you do not have limits and home connected at this time:
    - a. Click the **Limits & Home** button (  ).
    - b. In the **Forward Limit** and **Reverse Limit** sections ensure that the settings match the following:



**Note** These configuration settings disable limits for initial setup and testing purposes. National Instruments recommends connecting and enabling limits in your final application.

- Clear the **Enable** checkbox from both **Forward Limit** and **Reverse Limit**.
  - Set the **Active State** for both **Forward Limit** and **Reverse Limit** to **Off**. This prevents a limit warning even though limits are turned off.
- c. Open the **Home** section and clear the **Enable** checkbox.
8. Configure any additional I/O settings according to your system requirements, such as position compare or position capture signals.
  9. Click **OK** to close the **Axis Configuration** dialog box.
  10. Right-click the controller item in the **Project Explorer** window and select **Deploy All** to deploy the axis information. If a conflict resolution dialog box appears, click **Apply** to proceed with deployment.
  11. Select **File»Save Project** to save the project.

## Step 5: Enable and Test the Drive Using LabVIEW



Use the Interactive Test Panel to test and debug your motion system and configuration settings on the selected axis. With the Interactive Test Panel you can perform a simple straight-line move and monitor feedback position and position error information, move and I/O status information, change move constraints, get information about software errors and faults, and view position or velocity plots of the move.

Complete the following steps to test your setup after configuring the axis using the **Axis Configuration** dialog box.

1. Right-click the axis in the **Project Explorer** window and select **Interactive Test Panel** from the shortcut menu. Opening this dialog box sends the axis settings to the hardware and activates the I/O on the module.
2. On the **Move** tab set **Move Mode** to Relative Position and **Target Position** to 50 rev.
3. On the **Move Constraints** tab set **Velocity** to 10 rev/sec, **Acceleration** and **Deceleration** to 100 rev/sec<sup>2</sup>, and **Acceleration Jerk** and **Deceleration Jerk** to 1000 rev/sec<sup>3</sup>. Using the encoder counts per revolution and stepper steps per revolution values specified in this tutorial the motor will move 50 revolutions at 600 rpm.



**Tip** Click the **Help** button ( ? ) on the bottom of the dialog box for detailed information about the items available in this dialog box.

4. Click the **Enable** button (  ) on the bottom of the dialog box to enable the drive.
5. Click the **Start** button (  ) on the bottom of the dialog box to start the move with the configured options.
6. Use the **Status** and **Plots** tabs to monitor the move while it is in progress.

Finalize your motion system setup by connecting and configuring additional I/O such as limits as required by your system using the 37-pin terminal block.

# Worldwide Support and Services

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The National Instruments Web site is your complete resource for technical support. At [ni.com/support](http://ni.com/support) you have access to everything from troubleshooting and application development self-help resources to email and phone assistance from NI Application Engineers.

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